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Elektrische drehende Maschine

Machine électrique tournante

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- **PATENT ABSTRACTS OF JAPAN vol. 8 no. 115 (E-247) ,29 May 1984 & JP-A-59 028869 (FUJI DENKI KAGAKU K.K.) 15 February 1984,**
- **PATENT ABSTRACTS OF JAPAN vol. 16 no. 263 (E-1216) ,15 June 1992 & JP-A-04 058754 (TOUHOKU OKI DENKI KK) 25 February 1992,**

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Description

The present invention relates to an electrical rotating machine and more specifically, a stator structure in a stepping motor.

Stepping motors are widely used in computer peripherals, and other industrial apparatuses and enjoy their major role in drive application. The stepping motors are classified into PM, VR, and HB types depending on the structure of their rotors. Each stepping motor includes a bearing mechanism for supporting the shaft of a rotor which rotates in a stator magnet assembly provided with a given number of coils.

Fig. 6 is an exploded perspective view of a conventional stepping motor. As shown, a stator assembly 51 is made of a cylindrical form having a bottom and its interior will be explained later in more details. The stator assembly 51 has a terminal 53 provided at the side thereof. Leads are soldered to the terminal 53 for connection to an external circuit but not shown. An annular body of the stator assembly 51 is composed of yokes 55 of a magnetic conductive metal. There are two rows of upper stator magnetic poles 57 and lower stator magnetic poles 59 projecting inwardly from the yoke 55. A plurality of positioning protrusions 61 are provided on the top of the stator assembly 51.

Denoted by 63 is a rotor which rotates in the stator assembly 51 and is magnetized to have N and S poles. An end plate 65 is mounted to the top of the stator assembly 51. The end plate 65 has a bearing 69 provided in the center thereof for supporting a rotating shaft 67 of the rotor 63. There are positioning apertures 71 arranged about the bearing 69 in the end plate 65 to correspond to the positioning protrusions 61 of the stator assembly 51. Also, projections 73 to be melted by resistance welding are provided about the bearing 69 inwardly of the positioning apertures 71 as extending downwardly or towards the stator assembly 51. The projections 73 may be located between the positioning apertures 71. Denoted by 74 are alignment raised portions which extend downwardly from the end plate 65 to be fitted into a center or rotor 63 opening of the stator assembly 51 for centering the bearing 69.

Fig. 7 is a longitudinal cross sectional view of the conventional stepping motor. As shown in Fig.7, there are upper stator coils 75 and lower stator coils 77. The stator assembly 51 is fabricated by coupling the two yokes 55 of a bowl shape in cross section having magnetic poles, one containing the upper stator coils 75 and the other containing the lower stator coils 77, in a set of molds loaded in an injection machine, and filling the yokes 55 with an amount of resin material. During injection of the resin material, the positioning protrusions 61 are simultaneously formed. Denoted by 79 are burrs remaining in an injection resin inlet of the molds. Also shown is a lower bearing 81 secured in a bottom resin 83. Motor mounting tubs 85 and anchoring slots 87 are shown in Fig. 6.

As shown in Fig. 7, the assembling of the stepping motor or electrical rotating machine starts with placing the end plate 65 on the stator assembly 51 so that the positioning protrusions 61 are accepted in the positioning apertures 71 of the end plate 65, and applying a pulse current to heat up the projections 73 while pressing the end plate 65 against the yokes 55. As the result of the resistance welding, the end plate 65 is securely joined at welding points 89 shown in Fig. 8 to the stator assembly 51. It is however likely to allow particles of metal produced during the resistance welding to enter between the end plate 65 and the yoke 55 and between the stator assembly 51 and the rotor 63. Upon energizing the electrical rotating machine, the metal particles between the end plate 65 and the yoke 55 start flowing due to resultant vibration. Some of the metal particles are attracted by the action of a magnetic force on the rotor 63, thus traveling deep into a small clearance between the rotor 63 and the stator assembly 51. This will interrupt the smooth rotation of the rotor 63 or create rotation noises. If worse, the rotor 63 may be jammed to stop.

It is an object of the present invention, for eliminating the above disadvantage, to provide a novel stator structure in an electrical rotating machine which has a stator to one end of which an end plate provided with a bearing is fixedly mounted and a rotor rotatably supported by the bearing, characterised in that particles of metal produced during welding of the end plate to the stator are prevented from entering between the stator and the rotor.

JP-A-59028869 discloses a stator for an electrical rotating machine, the stator comprising a main body comprising at least one coil; and an end plate welded to the main body, and having a bearing for rotatably supporting a rotatable shaft; wherein a plurality of apertures are provided in the main body and/or the end plate, and a plurality of complementary protrusions are provided so as to mate with the apertures when the main body is engaged with the end plate; wherein a welding projection for welding the end plate to the main body is associated with each complementary pair of apertures and projections, the welding projection being located radially outwardly of each complementary pair.

According to a first aspect of the present invention, the stator is characterised in that the welding projection is provided on the main body. According to a second aspect of the present invention, such a stator is characterised in that a slit for removal of metal particles is associated with each complementary pair of apertures and protrusions, each slit being positioned radially outwardly of the respective complementary pair, and being provided either in the end plate or the main body.

The welding projections which may be melted for coalesce by resistance welding are provided substantially on a respective straight line extending from the centre of rotation across the positioning protrusions and on the outer side of the positioning protrusions respec-

tively. Upon the welding projections being melted, the end plate is joined to the main body. As unwanted metal particles produced during the resistance welding are blocked by the positioning protrusions, they will hardly flow towards the rotor.

In the accompanying drawings:-

Fig. 1 is a cross sectional view of an end plate showing one embodiment of the present invention;
Fig. 2 is a front view of the end plate;
Fig. 3 is a cross sectional view of a stepping motor;
Fig. 4 is a perspective view showing another embodiment of the present invention;
Fig. 5 is a perspective view showing next another embodiment of the present invention;
Fig. 6 is an exploded perspective view of a prior art;
Fig. 7 is an exploded cross sectional view of the prior art; and
Fig. 8 is a cross sectional view of the prior art.

Embodiments of the present invention will be described in more details referring to the accompanying drawings. Fig. 1 is a cross sectional view of an end plate of a stepping motor according to one embodiment of the present invention. Fig. 2 is a front view of the same. Like components are denoted by like numerals as described in the prior art and will be explained in no more details. As shown, the endplate of the embodiment is denoted by 10. The end plate 10 has a bearing 69 provided in the center thereof for supporting a rotating shaft 67. The end plate 10 also has positioning apertures 71 provided therein about the rotating shaft 67, similar to those in the prior art.

The positioning apertures 71 are so located as to correspond to positioning protrusions 61 provided upwardly on the top of a stator assembly 51. Each of the positioning apertures 71 is associated with a welding projection 12 which is to be heated by the resistance welding. The welding projection 12 is located on just the outer side of the positioning aperture 71 and on a straight line L extending from the center of the bearing 69, by which the rotating shaft 67 is supported, across the positioning aperture 71 in which the positioning protrusion 61 is accepted.

The end plate 10 is joined to the stator assembly 51 by placing the end plate 10 on the stator assembly 51 with its positioning apertures 71 accepting the positioning protrusions 61, and while pressing the end plate 10 against the yokes 55, applying a pulse current to heat up the welding projections 12 for coalesce. As the result of the resistance welding, the end plate 65 is securely joined at its welding points 14 shown in Fig. 3 to the top of the stator assembly 51. During the resistance welding, particles of metal may be produced and dispersed in all directions from the projections 12. A part of the metal particles which tends to flow towards the rotor 63 is blocked by the positioning protrusions 61 of the stator assembly 51. The remaining metal particles about the welding points 12 are also prevented from entering between the stator assembly 51 and the rotor 63. It is a good idea that surface regions of the end plate 10 just outside the projections 71 are slotted down at an angle θ as shown in Fig. 1 so that the metal particles are removed outwardly along the slots 17 as shown in Fig. 3.

The welding projections 12 of the previous embodiment are formed on the end plate 10. In another embodiment, welding projections 16 are provided on the upper yoke 55 of the stator assembly 51 as shown in Fig. 4. Each projection 16 is located outwardly of the positioning protrusion 61 and on a straight line extending from the center of the rotating shaft opening across the positioning protrusion 61.

As shown in Fig. 5, the slots 17 for removal of unwanted metal particles are arranged on the yoke 55 although they are on the end plate 10 outwardly of the positioning apertures 71 in the previous embodiment. It is understood that the present invention is applicable not only to the stepping motors but also to other small-sized motors and generators.

As set forth above, the stator structure in an electrical rotating machine which has a stator to one end of which an end plate provided with a bearing is fixedly mounted and a rotor rotatably supported by the bearing, according to the present invention is provided in that the positioning protrusions are formed extending axially from the one end of the stator, the positioning apertures are provided in the end plate for corresponding to and engaging with the positioning protrusions, and the welding projections to be melted by the resistance welding are arranged substantially on their respective straight lines extending from the center of rotation across the positioning protrusions and on the outer side of the positioning protrusions. Accordingly, unwanted metal particles produced during the resistance welding of the end plate to the stator are blocked by the positioning protrusions and will hardly flow towards the rotor. This allows the stator assembly to be free from such traditional disadvantages as sneaking of metal particles into a clearance between the stator magnetic poles and the rotor which may result in generation of noise and interruption of the rotation.

Claims

1. A stator for an electrical rotating machine, the stator comprising a main body (51) comprising at least one coil (75,77); and an end plate (10) welded to the main body, and having a bearing (69) for rotatably supporting a rotatable shaft (67); wherein a plurality of apertures (71) are provided in the main body and/or the end plate, and a plurality of complementary protrusions (61) are provided so as to mate with the apertures when the main body is engaged with the end plate; wherein a welding projection (12,16) for welding the end plate to the main body is asso-

ciated with each complementary pair of apertures (71) and projections (61), the welding projection being located radially outwardly of each complementary pair, characterised in that the welding projection (12,16) is provided on the main body.

2. A stator for an electrical rotating machine, the stator comprising a main body (51) comprising at least one coil (75,77); and an end plate (10) welded to the main body, and having a bearing (69) for rotatably supporting a rotatable shaft (67); wherein a plurality of apertures (71) are provided in the main body and/or the end plate, and a plurality of complementary protrusions (61) are provided so as to mate with the apertures when the main body is engaged with the end plate; wherein a welding projection for welding the end plate to the main body is associated with each complementary pair of apertures (71) and projections (61), the welding projection being located radially outwardly of each complementary pair; characterised in that a slit (17) for removal of metal particles is associated with each complementary pair of apertures (71) and protrusions (61), each slit being positioned radially outwardly of the respective complementary pair, and being provided either in the end plate (10) or the main body (51).

Patentansprüche

1. Ständer für eine elektrische rotierende Maschine, wobei der Ständer einen Hauptkörper (51) mit wenigstens einer Wicklung (75, 77) und eine am Hauptkörper angeschweißte Endplatte (10) mit einem Lager (69) zur drehbaren Lagerung einer drehbaren Welle (67) aufweist, wobei mehrere Öffnungen (71) im Hauptkörper und/oder der Endplatte vorgesehen und mehrere komplementäre Vorsprünge (61) vorgesehen sind, so daß sie mit den Öffnungen zusammenpassen, wenn die Endplatte am Hauptkörper anliegt, wobei jedem komplementären Paar aus einer Öffnung (71) und einem Vorsprung (61) ein Schweißvorsprung zum Anschweißen der Endplatte am Hauptkörper zugeordnet ist und der Schweißvorsprung radial außerhalb jedes komplementären Paares angeordnet ist, **dadurch gekennzeichnet**, daß der Schweißvorsprung (12, 16) auf dem Hauptkörper vorgesehen ist.

2. Ständer für eine elektrische rotierende Maschine, wobei der Ständer einen Hauptkörper (51) mit wenigstens einer Wicklung (75, 77) und eine am Hauptkörper angeschweißte Endplatte (10) mit einem Lager (69) zur drehbaren Lagerung einer drehbaren Welle (67) aufweist, wobei mehrere Öffnungen (71) im Hauptkörper und/oder der Endplatte vorgesehen und mehrere komplementäre Vorsprünge (61) vorgesehen sind, so daß sie mit den Öffnungen zusammenpassen, wenn die Endplatte am Hauptkörper anliegt, wobei jedem komplementären Paar aus einer Öffnung (71) und einem Vorsprung (61) ein Schweißvorsprung zum Anschweißen der Endplatte am Hauptkörper zugeordnet ist und der Schweißvorsprung radial außerhalb jedes komplementären Paares angeordnet ist, **dadurch gekennzeichnet**, daß jedem komplementären Paar aus einer Öffnung (71) und einem Vorsprung (61) ein Schlitz (17) zum Entfernen von Metallteilchen zugeordnet ist, wobei jeder Schlitz radial außerhalb des jeweiligen komplementären Paars angeordnet und entweder in der Endplatte (10) oder im Hauptkörper (51) vorgesehen ist.

Revendications

1. Stator pour une machine tournante électrique, le stator comprenant un corps principal (51) comprenant au moins une bobine (75, 77) ; et une plaque d'extrémité (10) soudée au corps principal, et comportant un palier (69) pour supporter de façon mobile en rotation un arbre (67) mobile en rotation ; dans lequel plusieurs ouvertures (71) sont prévues dans le corps principal et/ou la plaque d'extrémité, et plusieurs protubérances (61) complémentaires sont prévues de façon à s'accoupler avec les ouvertures lorsque le corps principal coopère avec la plaque d'extrémité ; dans lequel une saillie de soudage (12, 16) destinée à souder la plaque d'extrémité au corps principal est associée avec chaque paire complémentaire d'ouverture (71) et de protubérance (61), la saillie de soudage étant située radialement vers l'extérieur de chaque paire complémentaire, caractérisé en ce que la saillie de soudage (12, 16) est disposée sur le corps principal.

2. Stator pour une machine tournante électrique, le stator comprenant un corps principal (51) comprenant au moins une bobine (75, 77) ; et une plaque d'extrémité (10) soudée au corps principal, et comportant un palier (69) pour supporter de façon mobile en rotation un arbre (67) mobile en rotation ; dans lequel plusieurs ouvertures (71) sont prévues dans le corps principal et/ou la plaque d'extrémité, et plusieurs protubérances (61) complémentaires sont prévues de façon à s'accoupler avec les ouvertures lorsque le corps principal coopère avec la plaque d'extrémité ; dans lequel une saillie de soudage destinée à souder la plaque d'extrémité au corps principal est associée avec chaque paire complémentaire d'ouverture (71) et de protubérance (61), la saillie de soudage étant située radialement vers l'extérieur de chaque paire complémentaire ; caractérisé en ce qu'une encoche (17) destinée à éliminer des particules de métal est associée avec chaque paire complémentaire d'ouverture (71) et de

protubérance (61), chaque encoche étant disposée radialement vers l'extérieur de la paire complémentaire respective, et étant prévue soit dans la plaque d'extrémité (10) soit dans le corps principal (51).

Fig. 1

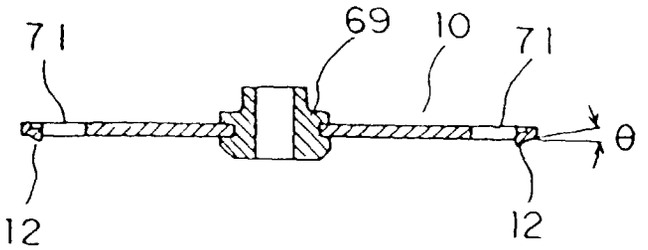


Fig. 2

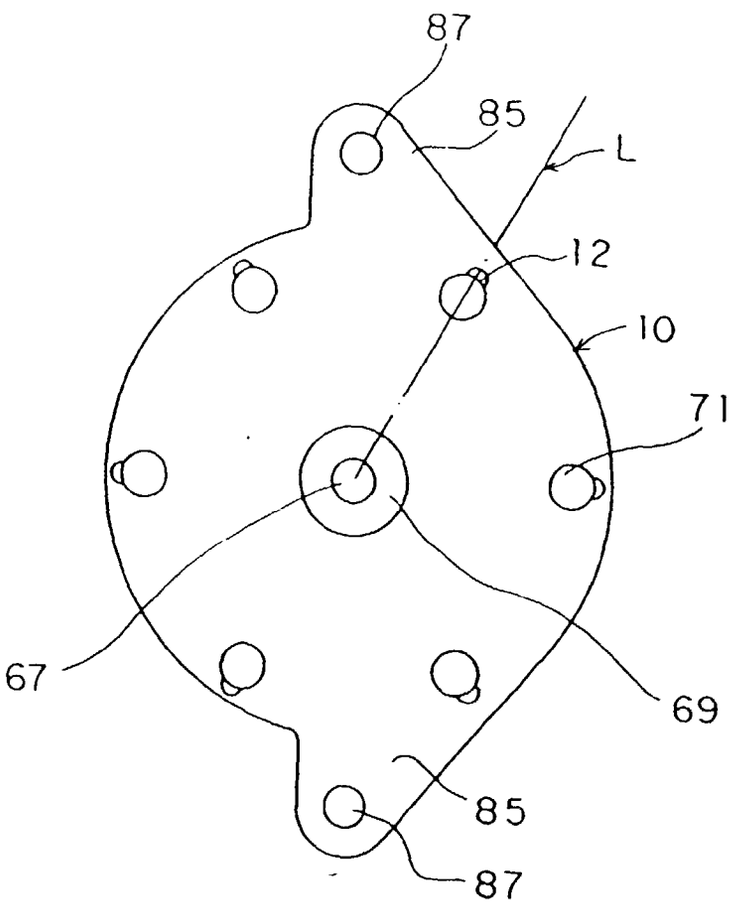


Fig. 3

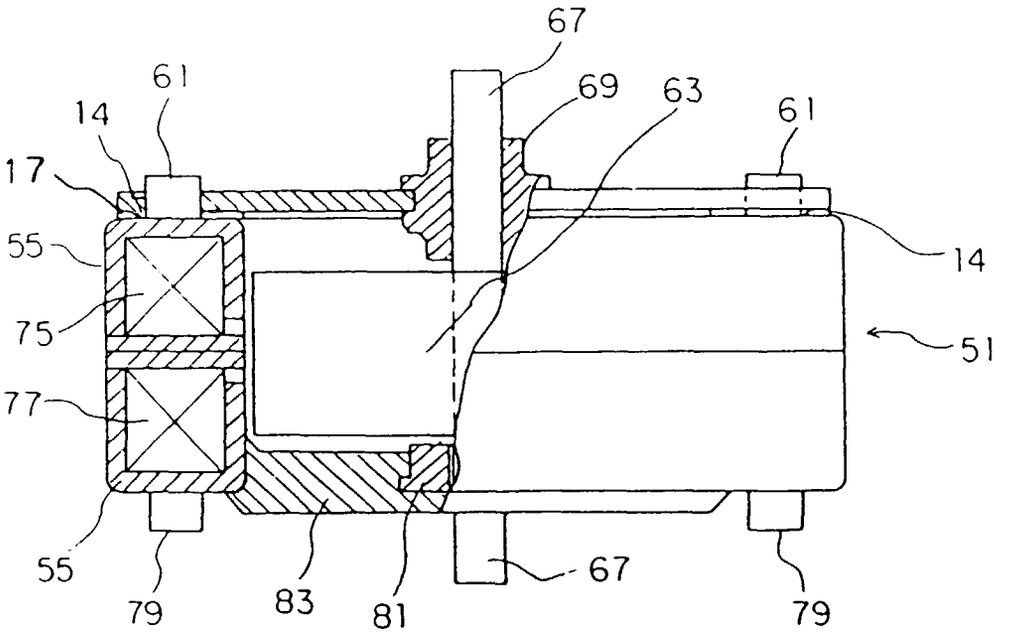

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Fig. 4

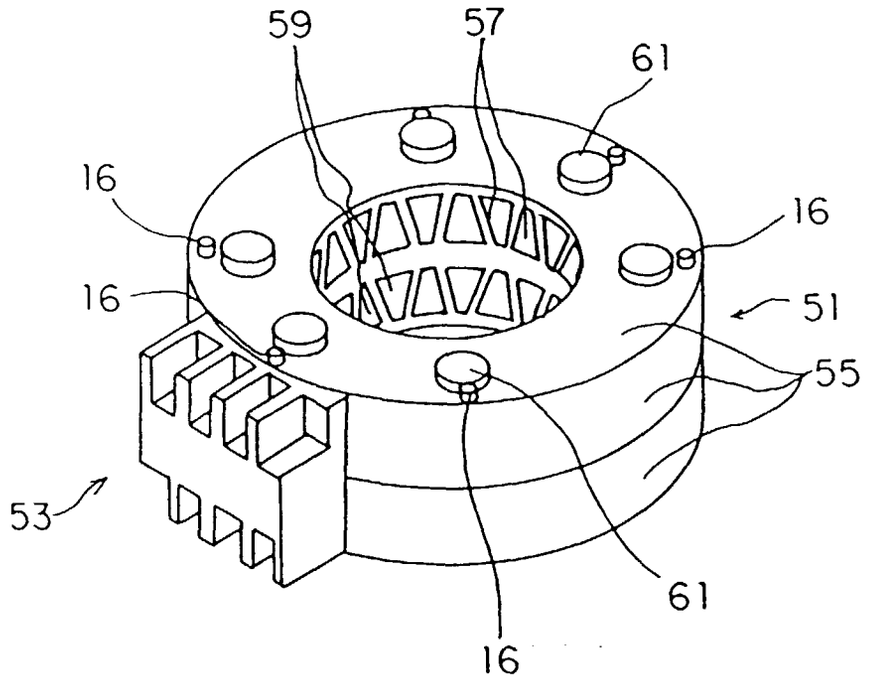

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Fig. 5

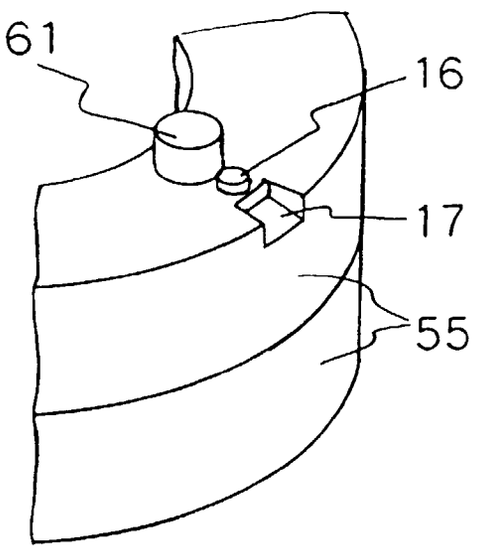


Fig. 6

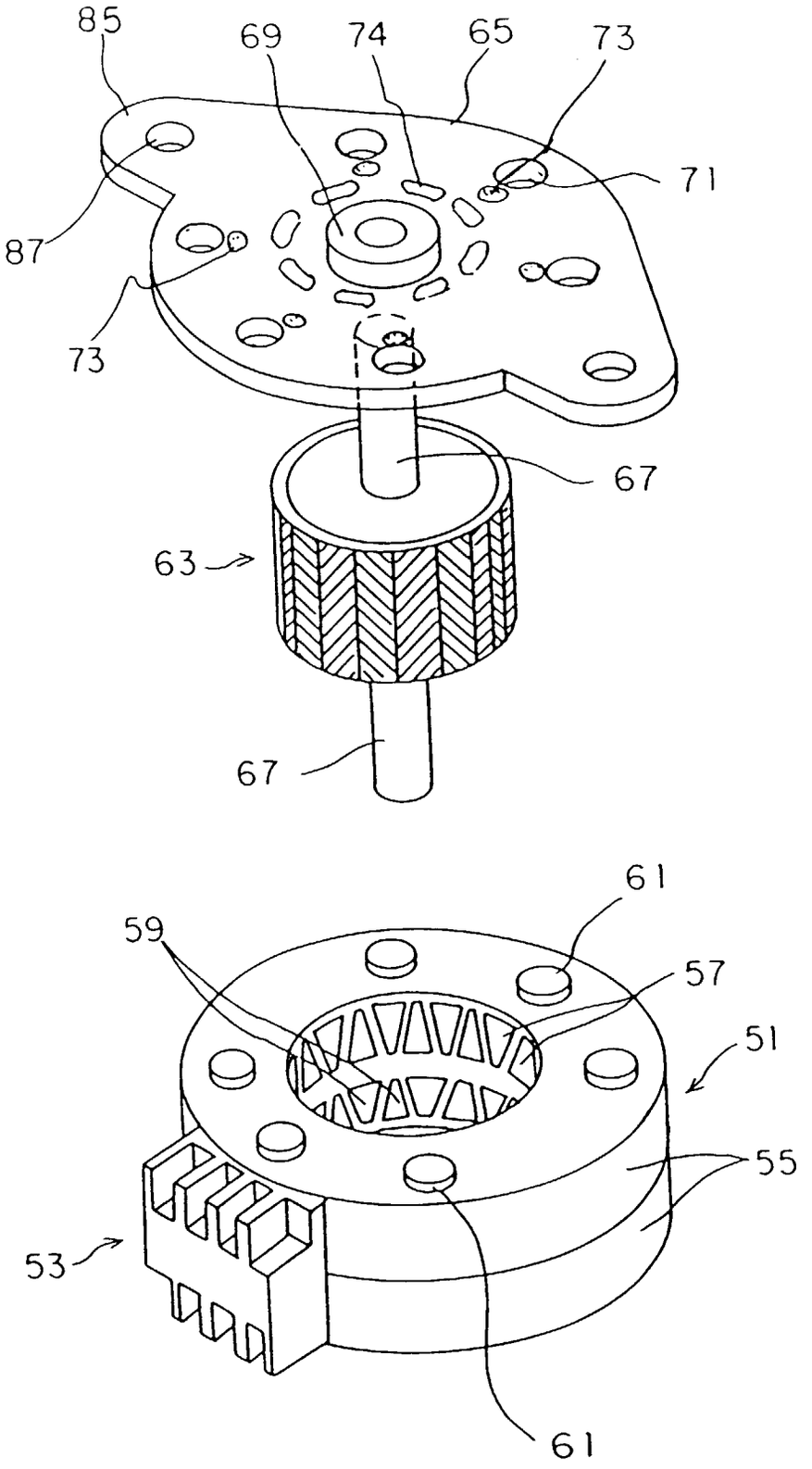


Fig. 7

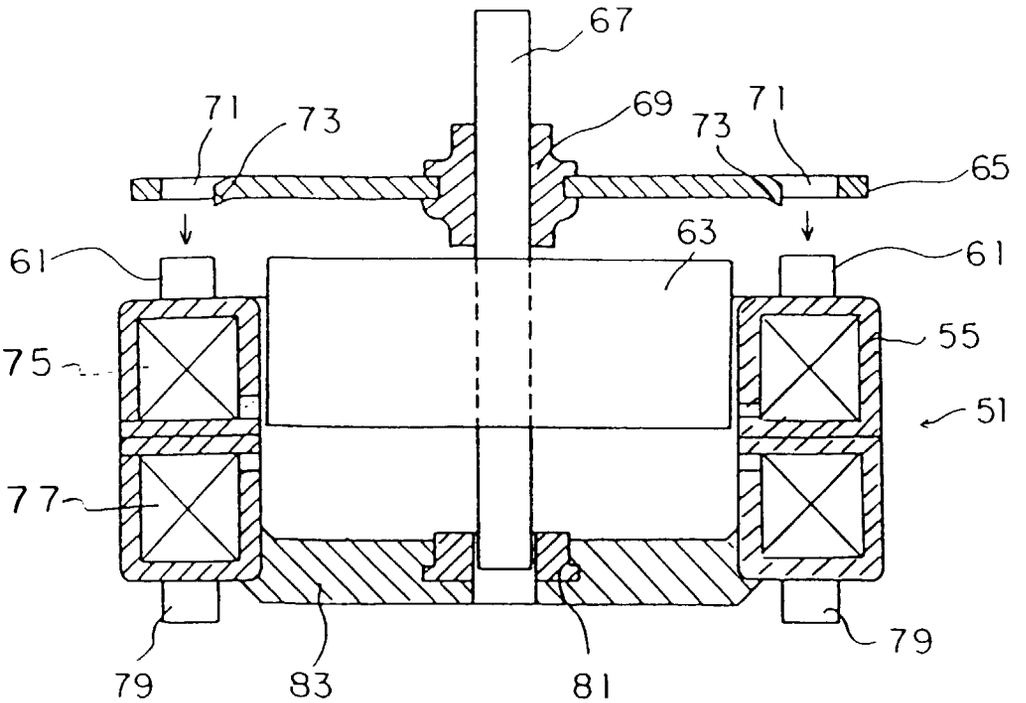
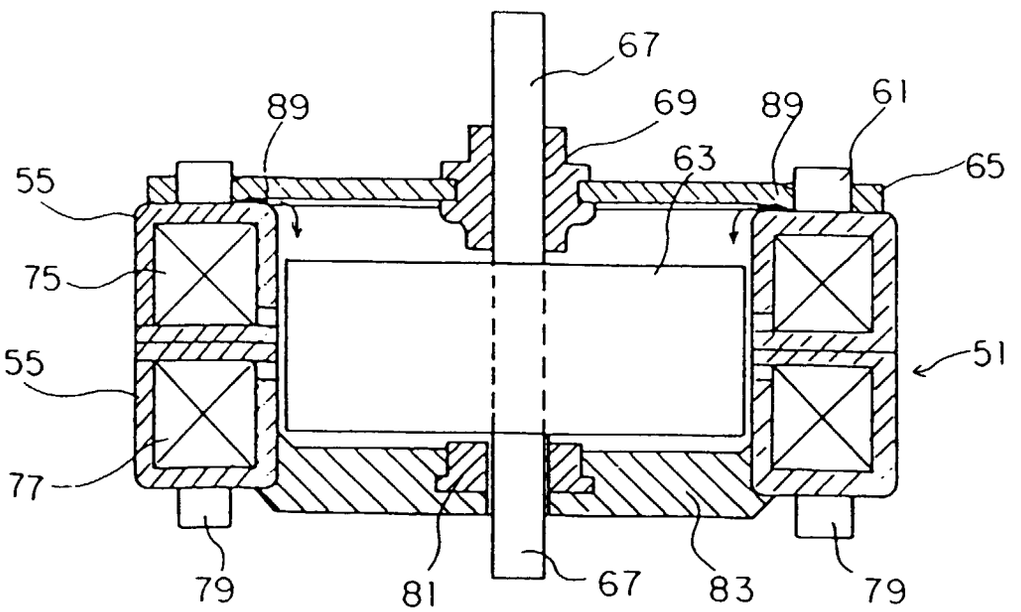

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Fig. 8


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